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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Seventh Semester, B.E. - Electrical and Electronics Engineering

Semester End Examination; Dec. - 2015

Computer Techniques in Power Systems

Time: 3 hrs *Max. Marks: 100*

***Note**: (i) Answer any **FIVE** full questions, selecting at least **TWO** full questions from each part.*
(ii) Missing data may suitably be assumed.

PART - A

1. a. Define primitive network and hence give the performance equations in Impedance and admittance forms. 6

b. The Bus incidence matrix for a network of 8 elements and 5 nodes is given below. Reconstruct the oriented graph, by forming the element- node incidence matrix. 6

$$A = \begin{array}{c} \text{Buses} \\ \downarrow \end{array} \begin{array}{c} \\ A \\ B \\ C \\ D \end{array} \begin{array}{c} \rightarrow\text{Elements} \\ \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ -1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & -1 & 0 & 0 & -1 & 1 & 0 & +1 \\ 0 & 0 & -1 & 1 & 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & -1 & 0 & 0 & -1 & -1 \end{pmatrix} \end{array}$$

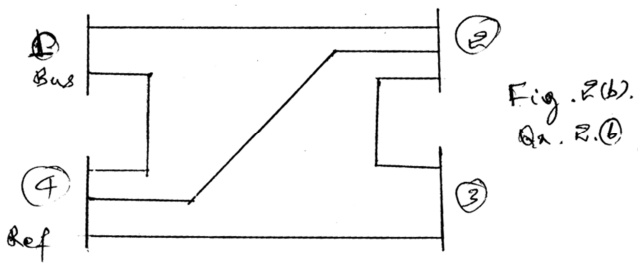
c. The terminal nodes of the elements of a 5 node graph having elements are given below. Each element is oriented from the "From node" towards the "To node". Draw the oriented graph and obtain $\hat{A}, \hat{B}$ and K matrices. And also verify the relations: (i) $A_b k^t = \cup$ (ii) $B_l = A_l K^t$ 8

Element no:	1	2	3	4	5	6	7	8
From Node	1	1	1	3	2	4	3	2
To Node	2	3	4	5	3	5	4	5
Type	Branches				Links			

2 a. Derive an expression for obtaining the Bus admittance matrix, Y_{bus}, using singular transformation technique. 6

b. For the net work shown in Fig. 2(b), obtain the bus admittance matrix, Y_{bus} by singular transformation analysis. Given, the line data as in the table below. 8

Line no.	Connecting nodes	Admittance in p.u.
1	1 - 4	1.4
2	1 - 2	1.6
3	2 - 3	2.4
4	3 - 4	2.0
5	2 - 4	1.8



c. Explain how tap changing transformers in a power system, are represented for Y_{bus} formation. 6

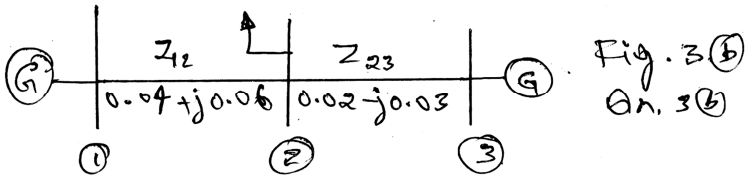
3 a. Discuss the classification of Buses for load flow analysis. And also explain the significance of slack bus in load flow analysis. 8

b. Determine the voltages at the end of first iteration using GS method for the system data given below.

Bus 1: Slack bus; $V = 1.04\angle 0^{\circ}\ p.u.$

Bus 2: P-Q bus; $S_2 = 6 - j1.4\{i.e., (P_2 - jQ_2)\}$

Bus 3: P-V bus; $|V| = 1.02\ p.u.,\quad P_3 = 0.8\ pu$ 12



4 a. Compare GS and NR methods of LFA. Mention the merits and demerits. 6

b. Derive the expressions for diagonal elements of Newton Raphson-Jacobian sub matrices. 8

c. Briefly explain Fast decoupled load flow solution method for solving the L.F. equations. 6

PART - B

5 a. Derive the necessary criterion (equation) for economic operation of power plants, considering transmission losses. 10

b. A power system consists of 2 generating units of capacity 100 MW each, whose cost curves are represented by the equation given below:

$C_1 = 0.05\ P_1^2 + 20\ P_1 + 800\ Rs./hr$

$C_2 = 0.06\ P_2^2 + 15\ P_2 + 1000\ Rs./hr$

If the total received power is 150 MW, what would be the division load between the units for most economical operation? Find the savings realized per hour from economic allocation of load between the units in comparison with their sharing the output equally when the load is 150 MW. 10

6 a. Derive B-coefficient (transmission loss coefficients) formula with usual notations. State the assumptions made. 10

b. A two bus system is shown in the figure Fig. 6(b). If 100 MW is transmitted from Plant 2 to load bus 1, a transmission loss of 10 MW takes place. Find the required generation for each plant and the power received by the load, when λ = 25 Rs./ MWhr. Use B-coefficients formula to calculate the coefficients. The incremented fuel cost are : 10

$$\frac{dC_1}{dP_1} = (0.04P_1 + 20)\ Rs./MWhr$$

$$\frac{dC_2}{dP_2} = (0.02P_2 + 16)\ Rs./MWhr$$

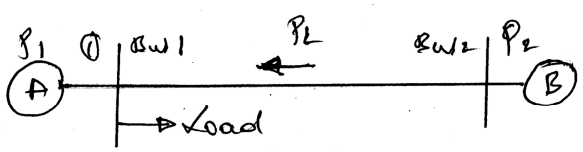


Fig. 6.(b) on. 6(b).

7 a. Derive the swing equation with usual notations. 8

b. With the help of equations, explain stability analysis using modified Euler's method. 8

c. Methods of improving transient stability. 4

8 Write short notes on only four: 20

(i) Range - Kutta method of stability analysis

(ii) Point-by-Point method

(iii) Penalty factors in economic operation

(iv) Performance curves of a thermal plant

(v) Limitation of NR-method of L.F.A.

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